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zontal line in the plane and through this point is not altered. Therefore

$$(M+m)v.R+MK^2.w=(M+m)v'.R+(MK^2+mk^2)w'.$$

Then, since $v=Rw$ and $v'=Rw'$,

$$v=\frac{(M+m)R^2+MK^2}{(M+m)R^2+MK^2+mk^2}v$$

$$=\frac{\sqrt{[(M+m)R^2+MK^2](M+m)R^2\ g\ \sin\alpha.l}}{(M+m)R^2+MK^2+mk^2}$$

For the motion down the lower half of the plane the equations are,

$$(M+m)\frac{d^2x}{dt^2}=(M+m)g\sin\alpha-F'$$

and $(MK^2+mk^2)\dfrac{d^2\theta}{dt^2}=F'R$ where F' is the friction.

Also, $x=R\theta$, $\dfrac{d^2x}{dt^2}=R\dfrac{d^2\theta}{dt^2}$.

Solving these for t, remembering that when $t=0$, $\dfrac{dx}{dt}=v'$, the time is found to be

$$-\sqrt{\frac{(M+m)R^2+MK^2}{(M+m)R^2g\sin\alpha}l}+\sqrt{\frac{(M+m)R^2+MK^2+(M+m)R^2+MK^2+mk^2}{(M+m)R^2g\sin\alpha}l}.$$

The whole time, therefore, is

$$\sqrt{\frac{2(M+m)R^2+2MK^2+mk^2}{(M+m)R^2g\sin\alpha}l}.$$

Since $K^2=\frac{2}{5}.\frac{R^5-r^5}{R^3-r^3}$ and $k^2=\frac{2}{5}r^2$, this becomes

$$\sqrt{\frac{10(M+m)(R^3-r^3)R^2+4M(R^5-r^5)+2m(R^3-r^3)r^2}{5(M+m)(R^3-r^3)R^2g\sin\alpha}l}.$$

Also solved by *P. H. PHILBRICK*, *WILLIAM HOOVER*, and *J. C. NAGLE*. We will publish one or all of these excellent solutions in the next issue.

PROBLEMS.

13. Proposed by G. B. M. ZERR, A. M., Principal of High School, Staunton, Virginia.

A man, horse and buggy are going around a circular race course at a 2:40 gait. If the whole outfit weighs 1500 lbs, radius of course is 500 feet and track is inclined so that pressure is equal upon the wheels, find the pressure on the ground due to whole weight.

14. Proposed by ALFRED HUME, C. E., D. Sc., Professor of Mathematics, University of Mississippi, University P. O.

"The center of a sphere of radius c moves in a circle of radius a and generates thereby a solid ring, as an anchor ring; prove that the moment of inertia of this ring about an axis passing through the center of the direct circle and perpendicular to its plane is $\dfrac{\pi^2\rho ac^2}{4}(4a^2+3c^2)$."

15. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

Show that the *eastward deviation* of bodies falling from a great height is

$$E_d=\frac{4\pi t(H-\frac{1}{2}\triangle)\cos\phi}{3T}.$$

Solutions to these problems should be received on or before August 1st.

DIOPHANTINE ANALYSIS.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS TO PROBLEMS.

5. Proposed by ISAAC L. BEVERAGE, Monterey, Virginia.

Find three numbers the sum of the squares of any two of which diminished by their product shall be a square number.

Solution by ARTEMAS MARTIN, LL. D., U. S. Coast and Geodetic Survey Office, Washington, D. C.

Let rx, ry, rz represent the numbers. Then we must satisfy

$$x^2-xy+y^2=\square\ \ldots.(1),$$
$$y^2-yz+z^2=\square\ \ldots.(2),$$
$$x^2-xz+z^2=\square\ \ldots.(3),$$

rejecting the square factor r^2.

Assume $x=2pq-q^2$, $y=p^2-q^2$, and (1) is satisfied. If we take $p=3$, $q=1$, we have $x=5$, $y=8$, and by substitution (2) and (3) become

$$z^2-5z+25=\square\ \ldots.(4),$$
$$z^2-8z+64=\square\ \ldots.(5).$$

Now put $(5)=(z-2n)^2$ and we get $z=\dfrac{16-n^2}{2-n}$.

Substituting this value of z in (4) and reducing, $n^4-5n^3+3n^2-20n+196=\square=(n^2-\frac{5}{2}n+14)^2$ say, whence $n=\frac{8}{5}$; therefore $z=\frac{168}{5}$, and, taking $r=5$, $rx=25$, $ry=40$, $rz=168$, three numbers satisfying the conditions of the problem,

Also solved by *H. W. DRAUGHON*, and *G. B. M. ZERR*.

6. Proposed by Professor G. B. M. ZERR, A. M., Principal of High School, Staunton, Virginia.

Find three whole numbers the sum of any two of which is a cube.

Solution by H. W. DRAUGHON, Clinton, Louisiana.

Let the three numbers be, $\frac{1}{2}(x^3+y^3-z^3)$, $\frac{1}{2}(x^3-y^3+z^3)$, and $\frac{1}{2}(y^3-x^3+z^3)$, then,

$$\tfrac{1}{2}(x^3+y^3-z^3)+\tfrac{1}{2}(z^3-y^3+z^3)=x^3,$$
$$\tfrac{1}{2}(x^3+y^3-z^3)+\tfrac{1}{2}(y^3-x^3+z^3)=y^3,\text{ and}$$
$$\tfrac{1}{2}(y^3-x^3+z^3)+\tfrac{1}{2}(x^3-y^3+z^3)=z^3.$$

In order that the numbers may be positive and integral we must make